The Seattle Times
seattletimes.com

November 20, 2007

SEEDING THE WAY FOR BETTER BIOFUELS

By Ángel Gonzalez

Fuels derived from crops are making inroads into the global energy mix, but many wonder whether the world has enough land to feed 6 billion mouths — let alone 600 million cars.

Tom Todaro, founder of Targeted Growth in Seattle, thinks a little genetics might help.

Armed with knowledge of a growth-controlling gene discovered at the Fred Hutchinson Cancer Research Center, Todaro's startup says it has bred a stronger, taller variety of camelina, an oilseed plant that doubles as a biodiesel source. The enhanced camelina yields 20 percent more oil than the standard variety and can be grown on marginal lands with little water or fertilizer.

On Tuesday, the company announced a partnership with Houston biodiesel maker Green Earth Fuels to produce 100 million gallons of fuel by 2010 from the new plant breed, to be grown mostly by Montana farmers.

"I believe help is on the way for the energy industry," Todaro said.

Targeted Growth's efforts address a major stumbling block for the biofuels revolution: the enormous quantity of land, water and fertilizer required to make a small dent in the demand for fossil fuel.

Other players — ranging from big oil companies to small entrepreneurs — are also scrambling to find alternatives to expensive crops like corn or soybeans, the source of most U.S. biofuels.

Some seek efficient ways to grow oil-rich algae in ponds, while others aim to unlock the energy contained in cellulose, potentially turning any kind of vegetable matter into a source of fuel.

"Sounds like the Holy Grail, but there's a lot of work associated with it," said Michael Weaver, Chief Executive of Bionavitas, a Seattle-area startup focused on algae production.

The biofuels debate has turned downright nasty, as corn and ethanol producers in the U.S. push for a government mandate to increase renewable-fuels consumption while critics argue that producing biofuels distorts food prices, wastes land and water, and encourages destruction of rain forests.

Growing biofuels demand puts pressure on the world's ability to grow food, while at the same time, high oil prices increase the cost of energy-intensive modern agriculture. "The problem is that we're asking agriculture to do everything," said Miguel Altieri, an environmental-sciences professor at the University of California, Berkeley.

Gargantuan needs

The land needs of the biofuels industry are gargantuan. In the U.S., nearly one-third of corn production will go to make ethanol by the end of the decade, replacing only 8 percent of gasoline use, according to the U.S. Department of Agriculture.

The department also projects that nearly a quarter of the nation's soybean crop will go to biodiesel, producing less than 2 percent of highway diesel consumed in the U.S.

Non-edible crops like jatropha could help relieve that burden. Oil giant BP and Indian firm D1 Oils are investing $160 million in a venture to grow the hardy plant, which has an oil-rich seed that's an excellent candidate for biodiesel.

Algae is also a popular option. The aquatic plants grow vertically in ponds and have a high energy content. "Some people say algae is a battery," Bionavitas' Weaver said.

But growing algae for biofuel is technically complex, and nobody has figured out how to do it profitably.

Targeted Growth's approach has been to cultivate more efficient plants. Its enhanced camelina is not transgenic, that is it does not contain genes from other species.

The company's researchers identified a gene in the plant that controls growth, and that allows them to scientifically select specimens with the right genes for a stronger breed.

"Your traditional farmer walks through the field and looks for a tall plant, but tall plants are like that for many reasons; the trait may not repeat," Todaro said.

Other approaches are even more experimental.

Developing a cost-effective way to extract fuel not from seeds or oils, but from cellulose — a plant's organic building block — could produce the highest yield of all. Agricultural waste, forestry slash and switchgrass could become rich sources of energy.

While soybean produces about 50 gallons of oil per acre per year, cellulose could yield some 2,500 gallons, said Chris Somerville, the recently appointed director of the Energy Biosciences Institute at Berkeley.

"In order to make best use of the land, you have to use the entire mass of the plant in a sustainable way," Somerville said.

While researchers at the University of Illinois and companies like Hayward, Calif.-based Mendel Biotechnology focus on domesticating tall grasses like Miscanthus for its

cellulose, genetic engineering of new varieties of yeast could help break down cellulose more easily, said Somerville.

In October, Genencor, a unit of food-ingredient giant Danisco, launched the first commercial enzyme for producing cellulosic ethanol.

Big obstacles

But scientists and entrepreneurs still have to overcome many challenges. Figuring out how to spread grasses like Miscanthus over a large area is difficult, because they can't be propagated by seed, Somerville said. The breakdown of cellulose is also to remain a technologically complex process, which may limit its application outside the developed world, he said.

Introducing new varieties of plants, including transgenics, is also tricky because their release into the wild could have unforeseen consequences, said Berkeley's Altieri.

The true solution, he said, is to redesign our society so that it uses less energy. "People must realize that overconsumption has to finish," he said.